ARTIFICIAL INTELLIGENCE

TEMPERATURE CONTROLLER

AI-208 (V7.6)

User Manual

I. Model Code Symbol

The type of AI-208 is made up of 4 parts:

AI-208	A	G	L2
Part 1 (Series)	Part 2 (Size)	Part 3 (Oupt)	Part 4 (AUX)

1. **(Part 1) Model Series**

   AI-208, standard temperature controller , 0.3%FS±1℃ accuracy.

   Multiple thermocouples and RTDs are selectable

   Suitable for 0~999℃ application. Maximum support two alarms contact output

   Universal voltage input (100~240VAC)

2. **(Part 2) Front panel dimension**

Size	Front Panel width×height	Cut Out width×height	Depth Behind Mounting Surface
A	96×96mm	92×92mm	100mm
B	160×80mm	152×76mm	100mm
D	72×72mm	68×68mm	95mm
D2	48×48mm	45×45mm	95mm
E	48×96mm	45×92mm	100mm
F	96×48mm	92×45mm	100mm

3. **(Part 3 and 4) indicate the module installed in OUTP and AUX sockets.**

Allowed modules in each socket are as below:

Allowed Type / Module Socket	N	L	L1	L5	G
3. OUTP (main output)		√			√
4. AUX (Auxiliary output)	√		√	√	

N (or none) no module installed

L Relay contact output module (Capacity: 5A/250VAC, normal open)

L1 Relay contact output module (Capacity: 2A/250VAC, normal open/ normal close)

L5 Dual relay output module Output module (Capacity: 2A/250VAC, normal open, support AU1 and AU2 alarm output)

G SSR voltage output module (30mA/5VDC)

II. TECHNICAL SPECIFICATION

1. **Input type :**
   Thermocouple: K, E, J, N
   Resistance temperature detector: Pt100
2. **Instrument Input range :**
   K, E, J, N : (0~+999)℃ ; Pt100: (0~+800)℃
3. **Measurement accuracy :** 0.3%FS±1℃
4. **Temperature display resolution :** 0 or 0.0 (0.0 just for 0~99.9 display)
5. **Control mode:**
   On-off control mode, or
   PID control with the function of parameter auto tuning.
6. **Alarm function:** High limit alarm, Lower limit alarm, Deviation High Alarm; providing the function of alarm blocking at the beginning of power on.
7. **Power supply voltage rating**: 100-240VAC, -15%, +10% / 50-60Hz.
8. **Power consumption:** ≤2W
9. **Ambient temperature:** -10~+60℃, Humidity: 0~90RH%

III. FRONT PANEL AND OPERATION

① Process Value(PV), or parameter code
② Set Value(SV), alarming code, or value of a parameter
③ Setup key, for accessing parameter table, and confirming change.
④ Data shift key, also for activating auto turning
⑤ Data decrease key
⑥ Data increase key
⑦ Status display LED,
OP1, AU1, AU2, and RUN indicate I/O operation of the corresponding module.

Basal display status:
When power on, will shows the process value (PV) and the set point (SV). If the input signal is out of the measurable range (for example, the thermocouple or RTD circuit is break, or input specification sets wrong). Instrument will alternately display “orA”, and limit alarm of PV, moreover, instrument will automatically stop the output.

IV. OPERATION DESCRIPTION

- **Set Value Setting:**
In basal display status, if the parameter lock “Loc” isn't locked, we can set setpoint (SV) by pressing ◁、▽ or △. Press ▽ key to decrease the value, △ key to increase the value, and ◁ key to move to the digit expected to modify. Keep pressing ▽ or △, the speed of decreasing or inscreasing value get quick. The range of setpoint is between the parameter SPH. The default range is 0 to 400.

- **Parameter Setting:**
In basal display status, press ↺ and hold for about 2 seconds can access Field Parameter Table. Pressing ↺ can go to the next parameter; if parameter have not locked, pressing ◁、▽ or △ can modify a parameter. Press and hold ◁ can return to the preceding parameter. Press ◁ (don't release) and then press ↺ key simultaneously can escape from the parameter table. The instrument will escape auomatically from the parameter table if no key is pressed within 30 seconds. Setting Loc=808 and then press ↺ can access System Parameter Table.

- **AI artificial intelligence control and auto tuning**
When AI artificial intelligence control method is chosen (CrL=AI), the PID parameters can be obtained by running auto-tuning. In basal display status, press ◁ for 2 seconds, the “At” parameter will appear. Press △ to change the value of “At” from “oFF” to “on”, then press ↺ to active the auto-tuning process. During auto tuning, the instrument executes on-off control. After 2-3 times of on-off action, the instrument will obtain the optimal control parameter value. If you want to escape from auto tuning status, press and hold the ◁ key for about 2 seconds until the "At" parameter appear again. Change “At” from “on” to “oFF”, press ↺ to confirm, then the auto tuning process will be cancelled.

Note 1: If the setpoint is different, the parameters obtained from auto-tuning are possible different. So you’d better set setpoint to an often-used value or middle value first, and then start auto-tuning. For the ovens with good heat preservation, the setpoint can be set at the highest applicable temperature. Depending on the system, the auto-tuning time can be from several seconds to several hours.

Note 2: Parameter Ctl (on-off differential, control hysteresis) has influence on the accuracy of auto-tuning. Generally, the smaller the value of Ctl, the higher the precision of auto tuning. But Ctl parameter value should be large enough to prevent the instrument from error action around setpoint due to the oscillation of input. Ctl is recommended to be 2.0.

Note 3: AI series instrument has the function of self-learning. It is able to learn the process while working. The control effect at the first run after auto tuning is probably not perfect, but excellent control result will be obtained after a period of time because of self-learning.

V. PARAMETER AND SETTING

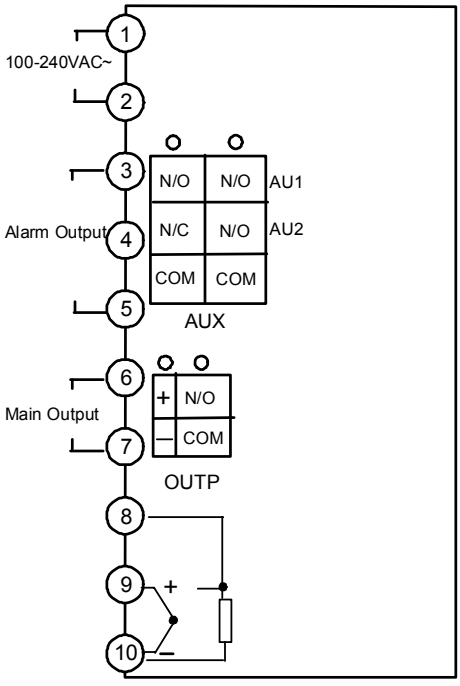
Field parameter table (Press ↻ and hold for 2 seconds to access)

<table>
<tr><th>Code</th><th>Name</th><th>Description</th><th>Setting Range</th></tr>
<tr><td>HIA</td><td>High limit alarm</td><td>Alarm on when PV (Process Value) >HIA;
alarm off when PV<HIA-AHY</td><td>0～999℃</td></tr>
<tr><td>LoA</td><td>Lower limit alarm</td><td>Alarm on when PV (Process Value) < LoA;
alarm off when PV > LoA+AHY</td><td>0～999℃</td></tr>
<tr><td>HdA</td><td>Deviation high alarm</td><td>Alarm on when PV-SV>HdA;
alarm off when PV-SV<HdA-AHY</td><td>0～999℃</td></tr>
<tr><td>Loc</td><td>Parameter lock</td><td>Loc=0~1: Allowed to modify parameters HIA, LoA, HdA and SV.
Loc=2~3: Allowed to modify parameters HIA, LoA, HdA. But cannot change SV.
Loc=4~255: NOT allowed to modify any parameters and SV.
Loc=808, Set to 808 and press ↻ , allowed modify all parameters.</td><td>0～255</td></tr>
<tr><td>AHY</td><td>Hysteresis</td><td>Avoid frequent alarm on-off action because of the fluctuation of PV, usually sets to AHY=2</td><td>0~200</td></tr>
<tr><td>AOP</td><td>Alarm output assignment</td><td>
<table>
<tr><th>Alarm / Output to</th><th>HdA (x100)</th><th>LoA (x10)</th><th>HIA (x1)</th></tr>
<tr><td>None</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>AU1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>AU2</td><td>2</td><td>2</td><td>2</td></tr>
</table>
eg: AOP=201 means HdA have alarm action from AU2, LoA, no alarm action , HIA alarm action output from AU1.</td><td>0~444</td></tr>
<tr><td>CrL</td><td>Control mode</td><td>● onF : On-off control, When PV=SV, Output stop. When PV<SV-CHY, start output.
● AI : AI PID control, high precision and the output time proportion can set by parameter Ctl</td><td></td></tr>
<tr><td>Act</td><td>Acting method</td><td>rE: Reverse acting. Increase in measured variable causes a decrease in the output, such as heating control.
dr: Direct acting. Increase in measured variable causes an increase in the output, such as refrigerating control.
rEb: Reverse acting with low limit alarm and deviation low alarm blocking at the beginning of power on.
drb: Direct acting with high limit alarm and deviation high alarm blocking at the beginning of power on.</td><td>rE , dr ,
rEb, drb</td></tr>
<tr><td>P</td><td>Proportion band</td><td>Proportion band in PID with unit ℃or ℉</td><td>1~999</td></tr>
<tr><td>I</td><td>Time of integral</td><td>Time of integral in PID. No integral effect when I=0</td><td>0~999 Sec</td></tr>
<tr><td>d</td><td>Time of derivative</td><td>Time of derivative in PID. No derivative effect when d=0</td><td>0~999 Sec</td></tr>
<tr><td>Ctl</td><td>Control period</td><td>Small value can improve control accuracy.
For SSR output, generally 0.5 to 3 seconds.
For Relay output, generally 15 to 40 seconds, because small value will cause the frequent On-Off of mechanical switch and shorten its service life. Ctl is recommended to be 1/4 – 1/10 of derivative time. When control under on-off control, Ctl use as restart delay time after off, for protect compressor application.</td><td>0.5-300 SEC</td></tr>
<tr><td>CHY</td><td>Control hysteresis</td><td>CHY is used for ON-OFF Control.
PV > SV, Output turns OFF;
PV<SV-CHY, Output turns ON.</td><td>0~200</td></tr>
</table>

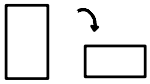
<table>
<tr><td>InP</td><td>Input specification</td><td><table>
<tr><td>Sn</td><td>Input spec.</td><td>Sn</td><td>Input spec.</td></tr>
<tr><td>0</td><td>K</td><td>1-3</td><td>Spare</td></tr>
<tr><td>4</td><td>E</td><td>5</td><td>J</td></tr>
<tr><td>6</td><td>Spare</td><td>7</td><td>N</td></tr>
<tr><td>8-20</td><td>Spare</td><td>21</td><td>Pt100</td></tr>
</table></td><td>0～21</td></tr>
<tr><td>dPt</td><td>Resolution</td><td>0 or 0.0 selectable, 0.0 just for 0~99.9 ℃ / ℉ display</td><td></td></tr>
<tr><td>Scb</td><td>Input shift</td><td>Scb is used to make input shift to compensate the error produced by sensor or input signal.
PV after compensation= PV before compensation + Scb.</td><td>-99～+99℃</td></tr>
<tr><td>FIL</td><td>PV input filter</td><td>The value of FIL will determine the ability of filtering noise.
When a large value is set, the measurement input is stabilized but the response speed is slow. Generally, it can be set to 1 to 3.
If great interference exists, then you can increase parameter “FIL” gradually to make momentary fluctuation of measured value less than 2 to 5.
When the instrument is being metrological verified, “FIL” s can be set to 0 or 1 to shorten the response time.</td><td>0～40</td></tr>
<tr><td>Fru</td><td>Selection of power frequency and temperature scale</td><td>50C: 50Hz, ℃
50F: 50Hz, ℉
60C: 60Hz, ℃
60F: 60Hz, ℉</td><td></td></tr>
<tr><td>SPH</td><td>Upper limit of SV</td><td>Maximum value that SV allowed to be. When SPH=400, the SV range will 0~400℃</td><td>0～999℃</td></tr>
</table>

VI. INSTRUMENT INSTALLATION AND WIRING

Wiring graph for instruments with dimension A, B, E or F

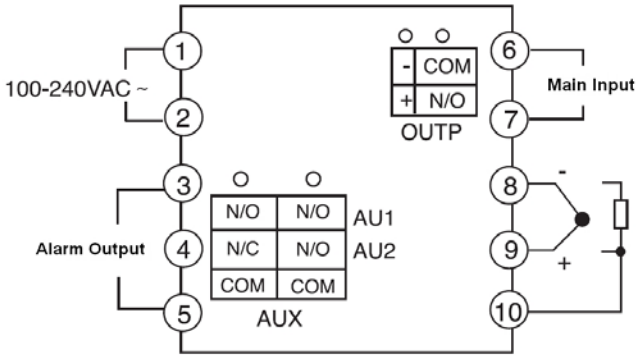


Note: The graph suits for upright instruments with dimension A or E



For instruments with dimension B or F size, just clockwise rotate the graph 90 degree.

Wiring graph for D2 dimension（48X48mm）instruments：



Wiring graph for D dimension (72mm X 72mm) instruments